In the Claims:

Please cancel claims 1-35 and replace with the following:

36. (New) A dynamically controllable photonic crystal comprising:

a) a structure having a periodic variation in dielectric constant and including a semiconductor substrate with at least one isolated resonant local defect positioned therewithin, the semiconductor substrate further comprising a three-layer structure comprising a center layer bordered by two external layers, the center layer having a higher equilibrium charge carrier concentration than the two external layers; and

b) an electrical mechanism operative to perform local depletion of charge carriers from the center layer in the vicinity of the at least one resonant local defect;

whereby the local depletion results in localized carrier refraction that enables dynamic control of electromagnetic wave propagation through the photonic crystal.

37. (New) The dynamically controllable photonic crystal of claim 36, wherein the three-layer structure defines two junctions, and wherein the electrical mechanism includes electrical biases applied to the two junctions.

38. (New) The dynamically controllable photonic crystal of claim 37, wherein the three-layer structure includes a structure selected from the group consisting of a PN^+P structure, a NP^+N structure, a NN^+N structure, and a PP^+P structure.

39. (New) The dynamically controllable photonic crystal of claim 37, wherein the semiconductor is silicon.

40. (New) A dynamically controllable silicon photonic crystal comprising:

a) a silicon substrate with a periodic array of air rods disposed therewithin and having a three-layer structure comprising a center layer bordered by two external layers, the center layer having a higher equilibrium charge carrier concentration than the two external layers, the three-layer structure further including at least one isolated resonant local defect; and

b) an electrical mechanism operative to perform local depletion of charge carriers from the center layer in the vicinity of the at least one resonant local defect;

whereby the local depletion results in a localized carrier refraction that enables dynamic control of electromagnetic wave propagation through the photonic crystal.

41. (New) The dynamically controllable photonic crystal of claim 40, wherein the three-layer structure defines two junctions, and wherein the electrical mechanism includes electrical biases applied to the two junctions.

42. (New) The dynamically controllable photonic crystal of claim 41, wherein the three-layer structure includes a structure selected from the group consisting of a PN^+P structure, a NP^+N structure, a NN^+N structure, and a PP^+P structure.

43. (New) A dynamically controllable photonic crystal comprising:

a. a structure having a periodic variation in dielectric constant and including a semiconductor substrate with at least one isolated resonant local defect positioned therewithin;

b. a local carrier concentration column formed in the semiconductor substrate around the at least one local defect and operative to have its carrier concentration changed electrically;

whereby the column carrier concentration change results in a local carrier refraction effect that may be used to dynamically control electromagnetic wave propagation through the photonic crystal.

44. (New) The dynamically controllable photonic crystal of claim 43, wherein the periodic variation in dielectric constant is effected by a periodic array of equal diameter air rods foormed in the semiconductor substrate, and wherein the local defect includes an air rod with a different diameter that the equal diameter.

45. (New) The dynamically controllable photonic crystal of claim 44, wherein the electrically induced change is effected by at least two nanocontacts formed on the semiconductor substrate.

46. (New) The dynamically controllable photonic crystal of claim 44, wherein the column carrier concentration change includes a change selected from the group consisting of a carrier concentration increase.and a carrier concentration decrease.

47. (New) The dynamically controllable photonic crystal of claim 45, wherein the periodic variation is defined by a lattice constant, and wherein a lateral dimension of each nanocontact is substantially no larger than three lattice constants.

48. (New) The dynamically controllable photonic crystal of claim 46, wherein the at least two nanocontacts include two nanocontacts defining a two-terminal device.

49. (New) The dynamically controllable photonic crystal of claim 46, wherein the at least two nanocontacts include three nanocontacts defining a three-terminal device.

50. (New) The dynamically controllable photonic crystal of claim 45, wherein the carrier concentration column includes a three-layer structure having a center layer with a lower equilibrium carrier concentration than the concentrations of two external layers, the three-layer structure selected from the group consisting of a PIN structure, a PNP struture, a NPN structure, a N^+NN^+ structure, a P^+PP^+ structure and a MSM structure.

51. (New) The dynamically controllable photonic crystal of claim 45, wherein the carrier concentration column includes a three-layer structure having a center layer with a higher equilibrium carrier concentration than the concentrations of two external layers, the three-layer structure selected from the group consisting of a PN^+P structure, a NP^+N structure, a NN^+N structure, and a PP^+P structure.

52. (New) The dynamically controllable photonic crystal of claim 44, wherein the semiconductor is silicon.

53. (New) The dynamically controllable photonic crystal of claim 52, wherein the carrier concentration column includes a structure selected from the group consisting of a symmetric CCD structure and a MOS structure.

54. (New) The dynamically controllable photonic crystal of claim 44, wherein the at least one air rod with a different diameter includes a plurality of coupled air rods with the same different diameter defining at least one coupled-cavity waveguide.

55. (New) The dynamically controllable photonic crystal of claim 54, wherein the at least one coupled-cavity waveguide is used to implement a device selected from the group consisting of a tunable optical filter, a tunable optical router, a tunable optical modulator and an optical switch.